

# AIRPORT-LIGHTING EQUIPMENT

COMPLYING WITH AIRPORT-RATING  
REGULATIONS OF  
U. S. DEPARTMENT OF COMMERCE  
AERONAUTICS BRANCH



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## RATING ON AERONAUTIC LIGHTING EQUIPMENT

SEC. 7. "A" RATING.—Airports receiving an "A" rating on aeronautic lighting equipment shall have the following:

(a) *Airport beacon.*—The airport beacon may be of either the rotating type or the fixed type with flashing light source. If of the rotating type, the beacon shall have a color characteristic consisting of either clear flashes or a combination of clear and aviation green flashes and shall be so operated as to show six clear flashes per minute in addition to any green flashes it may show. If of the flashing light source type, the beacon shall have a color characteristic consisting of either clear or aviation green flashes or a combination of the two and shall have a definite international Morse code characteristic. The vertical distribution of light and the location of the beacon shall be such as will insure the beacon being visible in all directions and at all vertical angles from the horizontal to within at least  $45^{\circ}$  of the zenith for altitudes of from 500 to 2,000 feet above the light source. In no case shall the luminous period be greater than 60 per cent nor less than 1 per cent, nor shall the duration of flashes be less than one-tenth second, nor shall the duration of eclipse periods exceed 10 seconds. For beacons of less than 50,000 candlepower, the luminous period shall be at least 35 per cent and the color characteristic shall be aviation green.

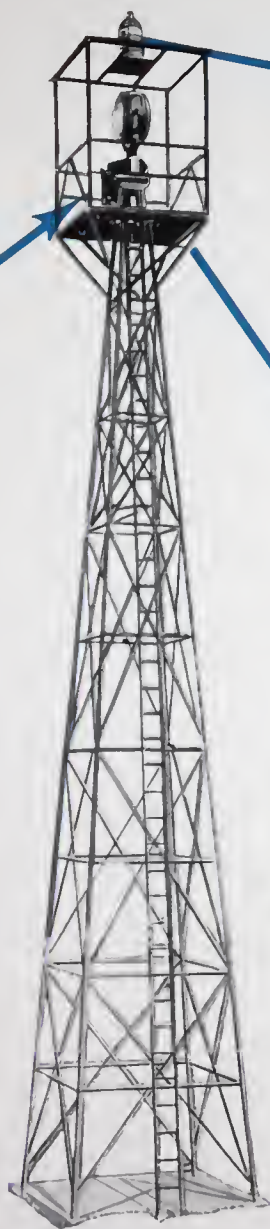
The beacon shall qualify under one of the following classes:

- (1) Beacons having a maximum candlepower of not less than 1,500,000 candles and a luminous period of not less than 1 per cent.
- (2) Beacons having a maximum candlepower of not less than 750,000 candles and a luminous period of not less than 2 per cent.
- (3) Beacons having a maximum candlepower of not less than 100,000 candles and a luminous period of not less than 10 per cent.
- (4) Beacons having a maximum candlepower of not less than 50,000 candles and a luminous period of not less than 20 per cent.
- (5) Beacons having a maximum candlepower of not less than 10,000 candles and a luminous period of not less than 35 per cent and that are aviation green in color.

In the case of beacons having a single lamp as the light source, an automatic lamp changer for bringing a spare lamp into the focal position shall be provided, or else there shall be an auxiliary beacon having a maximum candlepower of not less than 10,000 candles and a luminous period of not less than 35 per cent which is either kept in operation with the major unit or so designed as to be turned on automatically without interruption of service.

An auxiliary double-light-source beacon, aviation green in color and flashing a definite international Morse code characteristic, shall be installed on the airport in addition to the main beacon unless the main beacon includes one or more green flashes having a maximum candlepower of not less than 10,000 candles. Said auxiliary green beacon shall have a maximum candlepower of not less than 5,000 candles, a luminous period of not less than 35 per cent, and shall be so designed and erected that the light will be visible in all directions and at all vertical angles from the horizon to within at least  $10^{\circ}$  of the zenith. This auxiliary beacon may be a 300-millimeter airways electric code beacon equipped with aviation green color shades and two 500-watt, 110-volt, PS-40 clear incandescent lamps with C-7A filaments, or other equivalent apparatus. (On the Federal airways system, red auxiliary flashes are used at beacons where no landing fields are located, and green auxiliary flashes are used at beacons

# AIRPORT BEACONS



Electric code beacon  
(G-E Cat. No. 1229492G9)



Automatic lamp changer



24-inch rotating beacon  
(G-E Cat. No. 31X927)



20-in. enclosed rotating beacon  
(G-E Model No. 2AR9B1)

Rotating beacon and  
electric code beacon  
mounted on steel tower



Code flasher  
(G-E Cat. No. 3888423G1)

where intermediate fields have been established. The uniform use of red and green auxiliary flashes to indicate landing conditions will add materially to the safety of night flying.)

Wherever practicable the main airport beacon shall be installed directly on the airport or immediately adjacent thereto and in such manner as to be visible in all directions. In case the topography of the surrounding terrain is such as to necessitate installing the beacon at some distance from the airport, there shall be installed on the airport a green, flashing, double-light source, auxiliary beacon conforming to the foregoing requirements, even though the main beacon is green in color or has green flashes in its characteristic. In no case, however, shall the distance from the main beacon to the nearest edge of the landing area of the airport exceed 1 mile.

Flashing mechanisms used in connection with airport beacons shall be so designed as to cause no interference with radio reception.

(In code signals the duration of dashes should be three times the duration of dots, and the duration of eclipse periods between parts of the same letter should be not less than the duration of the dots. The eclipse between two letters should be not less than the duration of three dots and the eclipse between cycles should be not less than the duration of five dots. With flashing electric lights it is important that the time of heating and cooling the lamp filaments be taken into consideration.)

The code characteristics for airport beacons may be selected in each case by the airport, but shall be submitted to the Department of Commerce for approval in order to avoid duplication in any particular section of the country and consequent confusion.

On account of possible confusion with established nautical lights and a consequent interference with shipping, lighting plans for airports located in the vicinity of navigable waters should be submitted to the Department of Commerce, Washington, D. C., for consideration before the system is installed, in order to avoid any conflict between the proposed lighting system and existing lights established as navigational aids for water craft.

(b) *Illuminated wind-direction indicator.*—There shall be at least one illuminated wind-direction indicator, internally or externally lighted, equivalent in effect to either the wind cone or the wind tee described in paragraph (b) under the requirements for an "A" rating on general equipment and facilities. A lamp of not less than 200 watts with suitable reflector and weatherproof fittings will be required for the internal lighting of this wind cone. For external lighting a suitable system of reflectors with at least four 100-watt lamps and weatherproof fittings, or the equivalent, shall be so mounted above the wind cone as to make it readily visible in every direction. The wind tee may be illuminated by outlining with either exposed incandescent lamps or gaseous-discharge lamps, such as neon tubes, preferably placed along the center lines of the strokes of the tee or by flood lighting using a suitable system of reflectors with at least four 100-watt lamps with weatherproof fittings or the equivalent. For outlining with incandescent lamps, lamps of not less than 25 watts with weatherproof hoods (green recommended) spaced on not more than 12-inch centers shall be used. For outlining with gaseous tubes, either 11-millimeter by 18-millimeter or 15-millimeter by 25-millimeter tubing (green recommended) shall be used. (It is recommended that the illumination of the wind tee be by either exposed incandescent lamps or gaseous tubes.)



# WIND-DIRECTION INDICATORS



Wind cone with overhead reflectors and obstruction light



Typical wind tee with lights

(c) *Boundary lights.*—The outline of the entire area available for landing shall be shown at night by boundary lights spaced not more than 300 feet apart and served by an underground distribution system. Either series or multiple circuits may be used.

The cable used for boundary-light circuits shall be rubber-insulated moisture-proof underground cable, with either metallic or moisture-resisting nonmetallic sheathing and with jute or other suitable fiber serving, and shall be insulated for at least the maximum open-circuit voltage obtainable on the circuit. The cable conductors shall be of copper, and for multiple circuits they shall be of such size that the voltage drop will not exceed 5 per cent of the normal operating voltage of the circuit, but in the case of neither series nor multiple circuits shall they be less than No. 10 B. and S. gage. In the case of multiple circuits using either a 3-wire closed ring circuit or a straight 3-wire circuit, No. 10 B and S gage bare copper wire may be used for the third conductor. Such cable and wire shall be installed at a depth of at least 10 inches unless otherwise protected by suitable mechanical means. (In laying the cable it should be unreeled in place along or in the trench and not pulled in.)

For series circuits having normal operating voltages in excess of 310 volts, a series transformer (safety coil) shall be installed at the base of each boundary-light standard to prevent accident through high-tension current in event of collision with the light. However, in case the boundary light units are constructed so that the light socket or receptacle does not extend above the surrounding surface or so that the portion of the fixture above the surface will be knocked over and disconnected in event of collision, the circuit being automatically reestablished below the surface and the exposed receptacle automatically closed, or if other equivalent arrangement is provided, the series transformers are not required. In the case of series circuits with operating voltages of 310 or less the use of such series transformers is not required, providing the maximum open-circuit voltage does not exceed 450 volts. A series circuit using two constant-current transformers with the secondary windings of these transformers connected in series and with both the point of connection between these two secondary windings and a suitable point in the circuit effectively grounded, or other equivalent installation, may be used without the series transformers (safety coils) providing the operating voltage and the maximum open-circuit voltage at any part of the circuit do not exceed 310 and 450 volts, respectively. (A grounded circuit should not be installed without first finding whether it is in keeping with the practice of the power company supplying the current.)

Suitable weatherproof units with either plain or prismatic globes are required for the boundary lights. Such units shall be so constructed and installed that the light will be visible in all directions and at all vertical angles from the horizon to the zenith with no blind spots and shall be so designed as to prevent moisture entering the fixture and either grounding or short-circuiting the unit. On all series circuits these units shall be provided with cut-out sockets. In event of lamp failure such sockets are necessary to reestablish the circuit in the case of straight-series circuits and in the case of series circuits with series transformers (safety coils), to short-circuit the series transformer secondary. (An open-circuited secondary sets up electromagnetic waves of such a frequency as to interfere with radio reception in the immediate vicinity.) The extreme height of the light source of boundary-light units above the adjoining surface of the landing area shall not exceed 3 feet.

# AIRPORT BOUNDARY LIGHTS



Series-type boundary-light unit mounted on tip-over cone



Series-type boundary light

Note: Cones may be purchased separately for day marking without lights—to meet basic requirements as described on page 8 (page 7 of Airport Rating Regulations, issue of Sept. 1, 1931.)

Globe  
Cat. 2346117-Clear, shade etched  
Cat. 2346112-Ruby  
Cat. 2346111-Green

Fixture Cat. 1229462819

Cone-No 20 gauge galvanized sheet steel

Cat. 122949463  
Series cut-out with spring cover and 24 feet of two-conductor No. 8 flexible cable

Ground  
2" Conduit-12' long  
As shown by purchaser  
Compound  
Caulkum

Cable  
No. 8 AWG Single conductor type RLUF, RLJ or RJ  
Voltage to suit circuit conditions

1" Anchor or 1/2" rod by purchaser



Right, diagram of connections and specifications with G-E catalog numbers

Either clear or yellow lights shall be used in the boundary-light system, excepting as follows: Where the entire field is not available for landing in all directions at all times, green lights shall be so placed in the system as to indicate clearly the ranges of each landing strip or runway.

On multiple circuits, lamps of not less than 25 watts shall be used for clear and yellow lights and lamps of not less than 50 watts for green lights. In the case of series circuits, S-24½, 6.6-ampere, 600-lumen lamps shall be used for clear and yellow lights, and 1,000-lumen lamps for green lights. Diffusing globes or frosted lamps shall be used for all clear lights to prevent glare. Gaseous-discharge units, such as neon lamps, showing an intensity in all directions in the upper hemisphere at least equal to that of said incandescent units may be used in lieu thereof. Said gaseous-discharge units shall conform to the color requirements set forth in the preceding paragraph, and shall be so designed that the color will be permanent regardless of any low temperatures that may be encountered in service.

Boundary light units shall be so constructed as not to collect rubbish and shall be day marked in the manner described in section 4 (e) under Basic Requirements. Said units shall be kept clear and surrounding vegetation shall be trimmed in such a manner as to insure no interference with the visibility of either the lights or the markers.

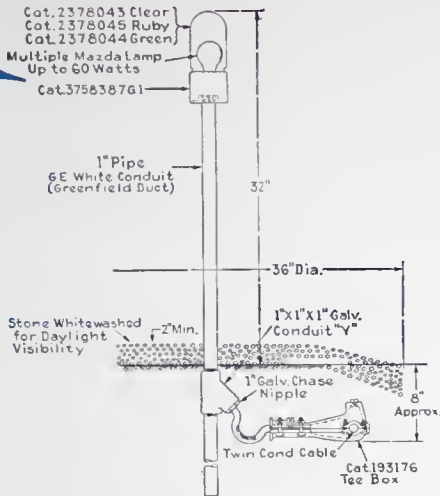
Obstruction lights marking pole lines or similar obstructions adjacent to the landing area will not be accepted in lieu of boundary lights. (In making night landings many pilots rely on the boundary lights to a certain extent to indicate the plane of the landing area, hence it is important that the height of boundary lights be not more than 3 feet. Also, the low boundary lights are of material assistance in preventing collision with fences and other obstacles when planes are taxiing near the edge of the landing area.)

(d) *Obstruction lights.*—All obstructions on and in the vicinity of the airport, including airport buildings and structures, shall be clearly marked with red lights which may be either incandescent lamps with red shades or gaseous-discharge lamps of distinctive red color. Obstruction lights shall meet at least the wattage, lumen, and candlepower requirements specified for green boundary lights. (In the case of high obstructions, the use of more powerful lights is recommended. Special lights are required for marking certain obstructions crossing navigable waters in the immediate vicinity of airports as hereinafter specified.) Suitable weatherproof units shall be used and shall be mounted in each case above the highest point of the obstruction or on poles of corresponding height placed alongside thereof. The use of a flashing mechanism in connection with the standard obstruction lights is not required or recommended; however, if such a mechanism is used, it shall be so designed as not to interfere with radio reception in the vicinity. Obstruction lights shall be placed on separate circuits from other field equipment and lighting installations, except that they may be included on the boundary-light circuit.

The obstruction lights marking each individual hangar or other long building contiguous to the landing area shall be placed not more than 300 feet apart. In marking a pole line an obstruction light shall be placed on each pole along the airport and on at least three poles beyond the airport in each direction. In case there is more than one pole line along the same side of the airport the obstruction lights shall be placed on the poles of the highest line.



# AIRPORT BOUNDARY AND OBSTRUCTION LIGHTS



Multiple-type boundary light

Left, diagram of connections and specifications with G-E catalog numbers



Left, multiple-type obstruction light with guard (G-E Cat. No. 1229462G48)

(While not required by these regulations, it is very desirable from the standpoint of safety that two obstruction lights be placed on end poles and on corner poles; otherwise the burning out of the single light in such locations may lead to serious results.) The spacing of lights marking such obstructions as a row of trees shall be not more than 300 feet.

All tall isolated obstructions in the vicinity of the airport exceeding 100 feet in height, such as radio towers and masts, flagpoles, transmission towers, water towers, chimneys, and other tall structures, shall be marked with at least two red lights placed directly above the obstruction and with red lights mounted on diagonal corners at two-thirds the height and also at one-third the height of the obstruction in such manner as to be visible from all angles of approach. In lieu of such red obstruction lights, chimneys, water towers, and similar structures may be marked by adequate flood lighting. It is recommended, however, that the red obstruction lights be used wherever possible.

Supporting towers of transmission line spans crossing navigable waters in the immediate vicinity of airports shall in each case be marked at the top with a red light visible in all directions and consisting of two 200-watt lamps mounted in a 300-millimeter airways electric obstruction lantern or other equivalent apparatus. In addition, red lights consisting of 100-watt lamps mounted in water-proof globes shall be installed on diagonal corners at the one-third and two-thirds heights of the towers in such manner as to be visible from all angles of approach. The catenary of the transmission line shall be night marked by one or more 24-inch parabolic directional projectors, as conditions may require, mounted on the supporting towers in such a manner as to show the location, direction, and height of the wires. The projectors shall be of sufficient candlepower adequately to mark the crossing by the indirect illumination of the beam, shall use lamps of not less than 1,000 watts, and shall be equipped with lamp changers.

Bridges crossing navigable waters in the immediate vicinity of airports shall, in addition to the lights prescribed by the Commissioner of Lighthouses for marine navigation, be provided with obstruction lights for air navigation as follows: The highest point of the bridge shall be marked with a red light visible in all directions and consisting of two 200-watt lamps mounted in a 300-millimeter airways electric obstruction lantern, or other equivalent apparatus. Should the bridge have several high spans or towers, such red lights shall be installed on each of the high points forming the obstruction.

[illegible]

Below, air markings for bridges

(e) *Illuminated roof markings.*—At least one hangar roof, or other suitable area, shall be marked in the manner set forth in section 4 (e). Said markings shall be illuminated by outlining with exposed incandescent lamps, gaseous-discharge lamps (neon tubes, etc.), or other equivalent apparatus, preferably placed along the center line of the strokes of the lettering and other symbols. For outlining with incandescent lamps, not less than 10-watt clear sign lamps shall be used, and lamps shall be spaced from 8 inches apart for 6-foot letters to 12 inches apart for 12-foot letters or larger. In case it is desired to use colored lamps, not less than 15-watt lamps shall be used for yellow and not less than 25-watt lamps for green and red. Gaseous-discharge tubes shall be either 11-millimeter by 18-milliamperes or 15-millimeter by 25-milliamperes tubing.

The presence of illuminated roof markings on an airport building does not eliminate the requirement for marking said building with suitable obstruction lights.

(f) *A ceiling projector.*—For use as a ceiling projector there is required an incandescent searchlight with a parabolic reflector of not less than 12 inches in diameter and with at least a 250-watt lamp of the concentrated filament type used for spotlight or headlight service and a stray light shield giving a beam spread of not to exceed 7° (preferably not more than 5°), or an equivalent apparatus. (Projectors limited to these minimum requirements will not necessarily be large enough to handle the needs of every airport. In some cases, depending upon local conditions, it may be necessary to use units up to 24 inches in diameter and with 1,000-watt lamps.) The ceiling projector shall be mounted on a yoke with a quadrant or other suitable means for elevating and holding the light at the proper angle. In case the projector is used in such a manner as to necessitate the measuring of vertical angles, an inclinometer, transit, or theodolite shall be provided, or in lieu thereof an alidade so graduated and installed as to give direct readings of the ceiling height.

(g) *Landing area flood-light system.*—This system, which may consist of one or more units, shall be such as to provide an even distribution of illumination (free from abrupt changes in intensity and from shadow areas) over the entire usable portion of the landing area. There shall be sufficient intensity of illumination to reveal the details of the surface and make depth perception readily possible from an altitude of at least 30 feet in the center of the lighted area. The minimum intensity of illumination over the usable portion of the landing area shall be not less than 0.15 foot-candle, measured at each point on the vertical plane of maximum illumination.

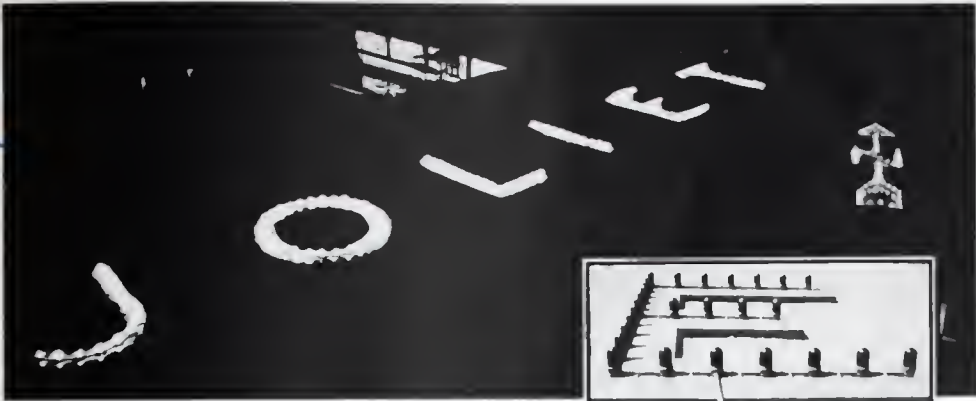
The flood-light system shall be immediately available for use through the operation of control located at convenient point and shall be sufficiently elaborate or flexible to permit landing under all conditions of wind direction without the necessity of landing directly toward the light source.

There shall be sufficient light to illuminate objects and obstacles in the immediate vicinity of the airport in the direction of the beam, and the flood-light unit or units shall be so designed and installed as to eliminate glare and blinding of the pilot.

Units shall be mounted as low as possible consistent with the contour of the landing area, shall project a beam of small vertical divergence with sharp cut-off at the top and with top of beam as nearly parallel with and as close to the surface of the landing area as practicable. Units using more than one lamp shall be so constructed that the failure of one or more lamps will not interrupt the service of remaining lamps. When more than one unit is used, each unit shall be separately fused or other suitable provision shall be made to prevent a short circuit in one unit from interrupting service of other units. In lighting areas of irregular, wavy contour, the units shall be so placed as to eliminate shadows.



## ROOF MARKINGS



## CEILING PROJECTOR



Left, ceiling projector  
(G-E Model No.  
3125104)  
Right, height indicator  
(G-E Model No.  
71E99)



Suggested method for roof markings.  
This involves standard wiring devices  
and fixtures

Below, typical airport illuminated by  
G-E Type ALH (24-kw.) floodlight

## LANDING-AREA FLOODLIGHTING



Where the flood lighting is accomplished from a single light source, an automatic lamp changer shall be provided to bring a new lamp into the focal position in case of lamp failure. This lamp changer shall be so designed that the reserve lamp is ready to be placed immediately on the line. In lieu of a lamp changer an auxiliary unit may be provided which will give sufficient light for safe landing of aircraft should the major unit fail, and which will produce a minimum intensity of illumination of not less than 0.035 foot-candle, measured at each point on the vertical plane of maximum illumination, over the usable portion of the landing area. This auxiliary unit, if not in operation with the major unit, shall be so designed as to be turned on automatically without interruption of service, and shall be located at or near the major unit in order to avoid confusion of the pilot due to sudden and unexpected change of location of the light source. In event said single light source is a high-intensity arc, neither an automatic lamp changer nor an auxiliary unit is required, providing the flood-light unit is at all times operated under the care of a competent attendant to see that carbons of sufficient length are in place each time the light is turned on and that the arc is kept functioning properly.

In case the landing area exceeds the size required for a class "1" rating at the altitude in question, the area to be flood lighted in the manner hereinabove specified shall meet at least the size requirements for a class "1" rating, but need not exceed these requirements, except in the case of landing areas receiving a class "T" rating. In such cases, the area to be flood lighted in said manner shall meet at least the size requirements for a class "T" rating, but need not exceed these requirements. It is highly desirable, however, that the entire landing area be lighted.

(Night operations are facilitated by the flood lighting of loading areas, hangar aprons, and taxiways leading from aprons to landing area. While it is not required that the exterior surfaces of airport buildings be flood lighted, the exterior lighting of one or more outstanding buildings will add to the general visibility of the airport. Units for such exterior flood lighting should be so installed as not to produce a glare that will interfere with planes using the port.)

(h) *All-night operation of lighting equipment.*—The airport beacon, wind-direction indicator lights, boundary lights, obstruction lights, and roof-marking lights shall be kept burning all night (from sunset until sunrise) every night. (It is preferable that this equipment be kept burning from one-half hour before sunset until one-half hour after sunrise.)

(i) *Night personnel.*—Sufficient personnel shall be in attendance throughout the night for proper operation of the lighting equipment, servicing aircraft, making minor repairs, giving weather service, and operating the fire-fighting equipment.

"B" RATING.—Airports receiving a "B" rating on night-lighting equipment shall have the following:

(a) Airport beacon equipment as required for an "A" rating.  
(b) Illuminated wind-direction indicator as required for an "A" rating.

(c) Boundary lights as required for an "A" rating.

(d) Obstruction lights as required for an "A" rating.

(e) At least one hangar roof, or other suitable area, shall be marked in the manner set forth in section 4 (e). In case such markings include a letter or letters indicating directions of flow of air traffic circling the landing area, said letter or letters shall be illuminated in the manner required for an "A" rating. Other markings shall be so illuminated as to be legible from an altitude of at least 2,000 feet. (It is recommended that said other markings be illuminated by exposed incandescent lamps or by gaseous-discharge tubes as required for an "A" rating. If the illumination of said

# AIRPORT FLOODLIGHTS

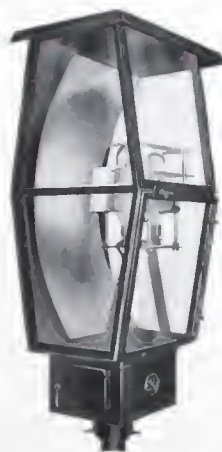


Above, Type ALH (24-kw.)  
airport floodlight



Left, Type ALF (500- or 1,000-watt)  
hangar floodlight  
(G-E Model No. 2ALF2A1)

Below, Type ALD (3-kw.) floodlight  
(G-E Model No. 2ALD1A1)



Above, Type ALH (3-kw.)  
airport floodlight  
(G-E Model No. 2ALH5B1)



Left, Type ALF (1- or 1.5-  
kw.) airport floodlight  
(G-E Model No. 2ALF1A1)

other markings is by flood lighting, either industrial reflectors or flood-light projectors may be used, and the intensity of illumination should be at least 10-foot candles and preferably 15-foot candles.)

(f) A ceiling projector as required for an "A" rating.

(g) A landing area flood-light system, portable or otherwise, which will provide suitable illumination for safe landing of airplanes under ordinary conditions and which will give a minimum intensity of illumination over the usable portion of the landing area of at least 0.035-foot candle, measured at each point on the vertical plane of maximum illumination.

In case the landing area exceeds the size required for a class "1" rating at the altitude in question, the area to be flood lighted in the manner hereinabove specified shall meet at least the size requirements for a class "1" rating, but need not exceed these requirements, except in the case of landing areas receiving a class "T" rating. In such cases, the area to be flood lighted in said manner shall meet at least the size requirements for a class "T" rating, but need not exceed these requirements. It is highly desirable, however, that the entire landing area be lighted.

(h) All-night operation of lighting equipment as required for an "A" rating.

(i) Sufficient personnel in attendance throughout the night for proper operation of the lighting equipment, servicing aircraft, giving weather service, and operating fire-fighting equipment.

"C" RATING.—Airports receiving a "C" rating on night-lighting equipment shall have the following:

(a) Airport beacon equipment as required for an "A" rating.

(b) Illuminated wind-direction indicator as required for an "A" rating, except that said wind-direction indicator shall be equivalent in effect to at least the wind-direction indicator required for a "C" rating on general equipment and facilities.

(c) Boundary lights as required for "A" rating.

(d) Obstruction lights as required for an "A" rating.

(e) A ceiling projector as required for an "A" rating.

(f) At least one hangar roof, or other suitable area, shall be marked in the manner set forth in section 4 (e), and said markings shall be illuminated as required for a "B" rating.

(g) All-night operation of lighting equipment as required for an "A" rating.

(h) Attendance available on request.

"D" RATING.—Airports not possessing sufficient aeronautic lighting equipment to receive a "C" rating, but which possess airport beacon equipment as required for an "A" rating, boundary-light system, an illuminated wind-direction indicator, and adequate obstruction lights, will be given a rating of "D" providing all such lighting equipment is kept burning all night every night.

"E" RATING.—Airports having the necessary aeronautic lighting equipment to meet the requirements of any of the above ratings and which keep this equipment available for operation on request, but which do not give the all-night operation required for these ratings, will be given the rating of "E."

"X" RATING.—The rating of "X" will be given to airports having no aeronautic lighting equipment, or which do not provide all-night operation of lighting equipment and which do not keep this equipment available for operation on request as hereinabove required.

**"LIGHT WILL PUT YOUR AIRPORT ON THE NIGHT MAP OF AMERICA"**